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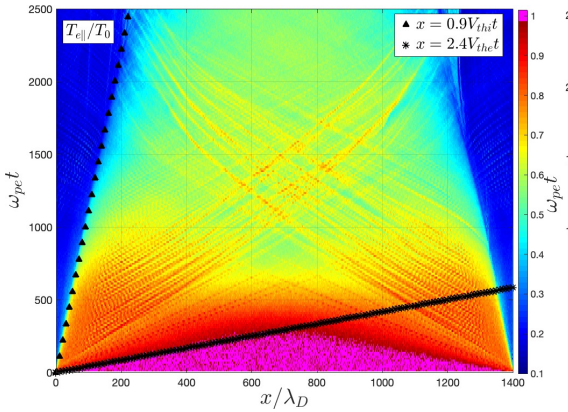
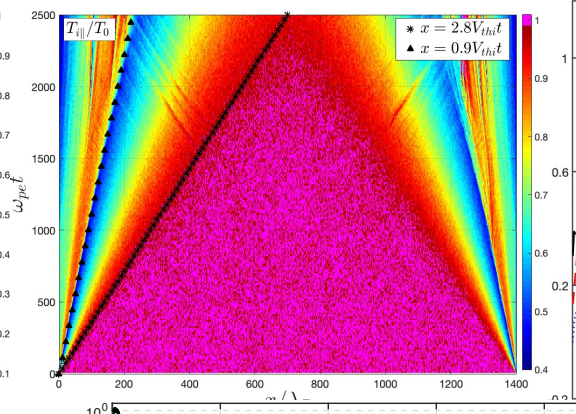
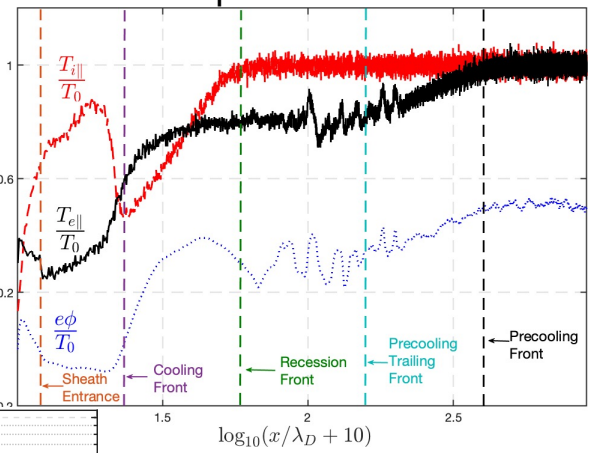
Thermal quench of open field plasma intercepting with recycling walls

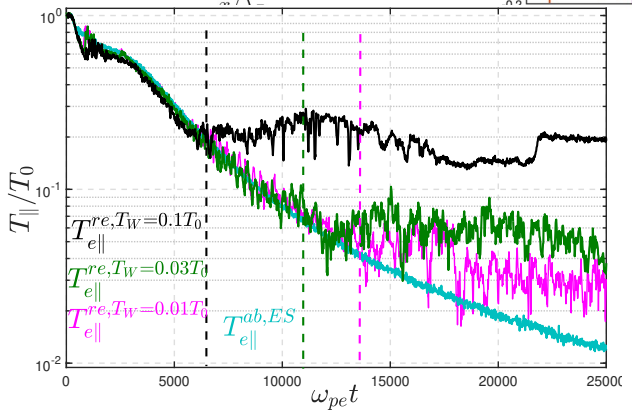
- When a fusion plasma suddenly intercepts a solid surface (wall or pellet), thermal collapse is distinctly kinetic & has novel physics
- VPIC simulations & theory revealed the fascinating dynamics of four propagating fronts controlling parallel electron temperature cooling
  - Two electron fronts with speed of $\sim v_{the}$
  - Two ion fronts with speed of $\sim C_s$







- Underlying physics
  - Between electron fronts: $q_{\|e} \sim n_e T_e v_{the}$
  - Between ion fronts: $q_{\|e} \sim n_e T_e V_{\|e} = n_e T_e V_{\|i}$ subject to the ambipolar transport
  - Cooling front, acted as a shock, isolate the core plasma from wall temperature T_w : the ambipolar transport between the ion fronts determines the ultimate cooling history of center $T_{\|e}$ till T_w



- The kinetic instability and wave-particle interaction leads to temperature isotropization that cools down perpendicular electron temperature